

FIROUZI CONSULTING ENGINEER, INC.

SKYTRON SURGICAL PRODUCTS

DES.

SHEET

LFSst2323

FOR SEISMIC ZONE (4), SOIL PROFILE (Sd)
NEAR SOURCE FACTOR = 1.5

FCE
JOB No.

1

DATE: 4-6-04

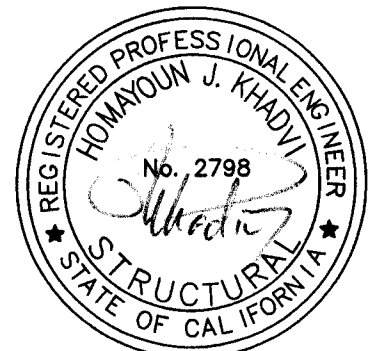
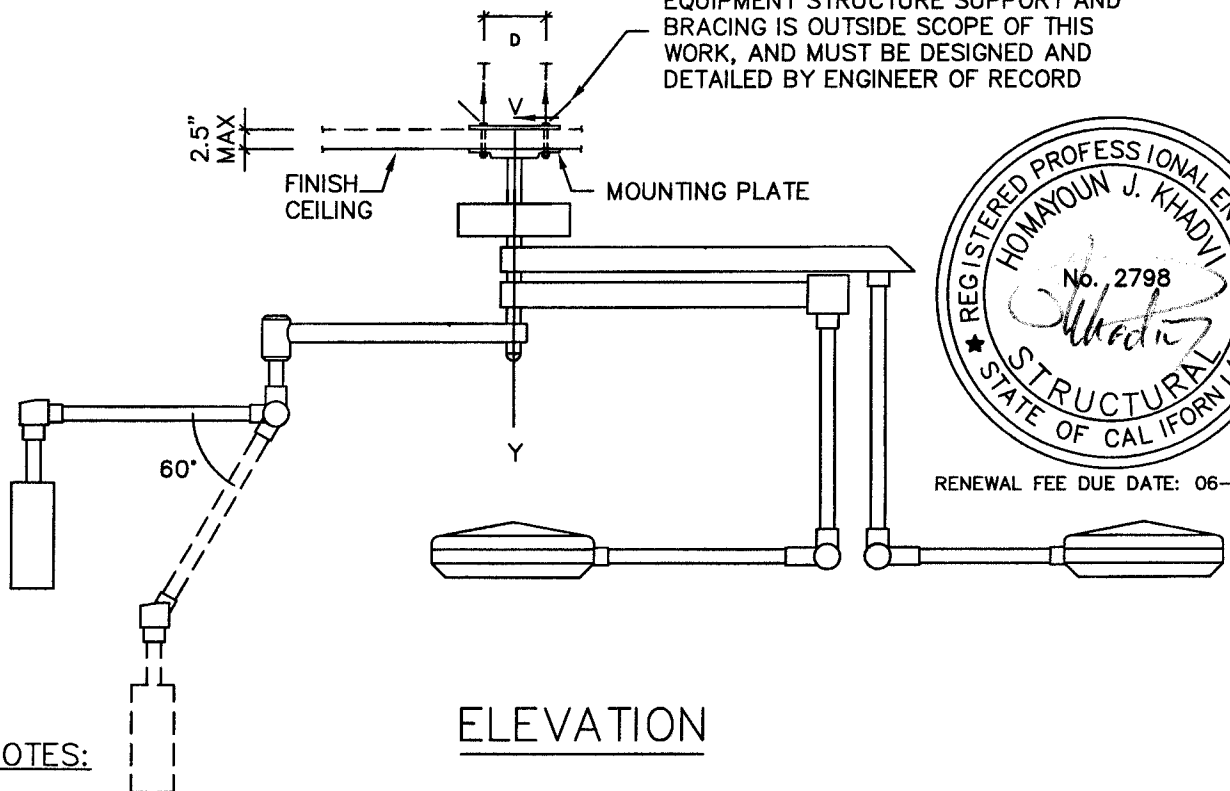
OF 4 SHEETS

SEISMIC ANCHORING BOLT DESIGN

LFSst2323

*BY OTHERS:

EQUIPMENT STRUCTURE SUPPORT AND
BRACING IS OUTSIDE SCOPE OF THIS
WORK, AND MUST BE DESIGNED AND
DETAILED BY ENGINEER OF RECORD



RENEWAL FEE DUE DATE: 06-30-06

ELEVATION

NOTES:

1. SCOPE OF WORK: DESIGN OF BOLTS CONNECTING MOUNTING PLATE TO STRUCTURE ONLY.
2. FORCES ARE DETERMINED PER 2001 CALIFORNIA BUILDING CODE – SECTION 1632A, (INCLUDING UP TO DATE REVISIONS) AND HAVE BEEN FACTORED TO REPRESENT WORKING DESIGN LOADS, NOT ULTIMATE
3. FORCES ARE MAXIMUMS AND OCCUR WHEN EQUIPMENT IS MOVED TO ITS MOST ECCENTRIC POSITION.
4. PROVIDE CEILING STRUCTURE DESIGNED AND DETAILS TO SUPPORT WEIGHTS AND FORCES SHOWN (BY ENGINEER OF RECORD FOR THE BUILDING)
5. ENGINEER OF RECORD TO DESIGN, DETAIL AND VERIFY STRUCTURE AND/OR EXISTING LIGHT SUPPORT TRACTS TO SUPPORT INDICATED LOADS
6. HORIZONTAL FORCES AND MOMENT MAY OCCUR IN ANY DIRECTION, ACTING AT THE TOP OF MOUNTING PLATE.

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DESIGN CRITERIA:

FORMULA 32A-1: $F_p = 4.0 C_a I_p W_p$

TABLE 16A-Q : $C_a = 0.44 N_a = 0.44 * 1.5 = 0.66$ (For zone 4 & S D)

TABLE 16A-K : $I_a = 1.5$ (For essential facility)

$\therefore F_p = (4.0)(0.66)(1.5)W_p = 3.96 W_p$ (For LRFD)

$F_p = 3.96 W_p / 1.4 = 2.83 W_p$ (For ASD)

FORMULA 30A-1: $E = p E_h + E_v$

$E_h = F_p$

$p = 1.0$ (FOR COMPONENT)

$E_v = (0.5) C_a I_p W_p$

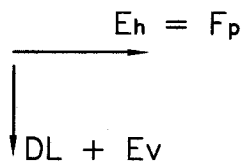
$= (0.5)(0.66)(1.5)W_p = 0.5 W_p$ (For LRFD)

$= 0$ (For ASD)

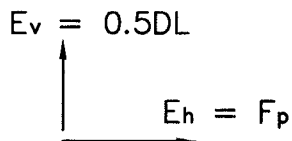
SECTION 1630A.11: $E_v = (0.7) C_a I W_p$

$= (0.7)(0.66)(1.5)/1.4 = 0.5 W_p$ (For ASD) [NET UPLIFT FORCE]

LOAD COMBINATION CASE A



LOAD COMBINATION CASE B



BY COMPARISON LOAD, COMBINATION A GOVERNS

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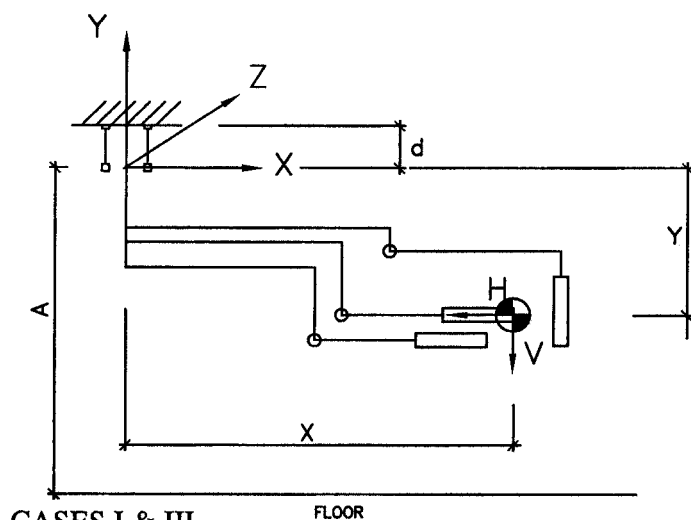
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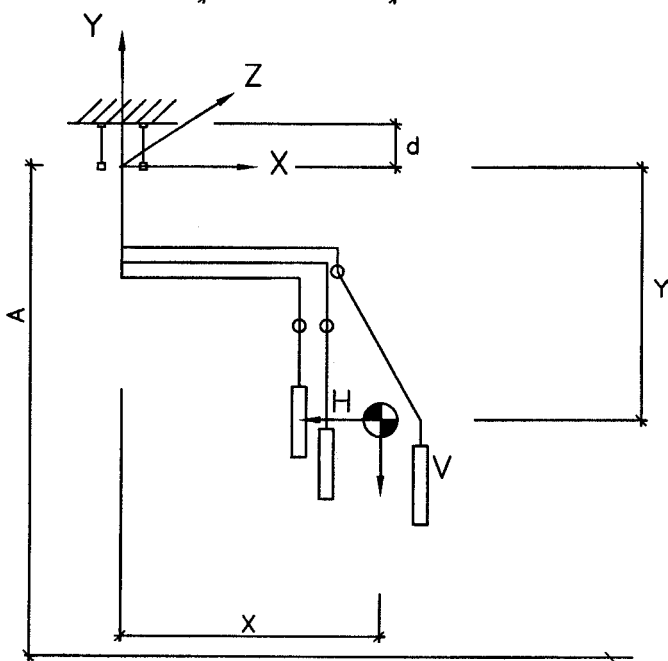
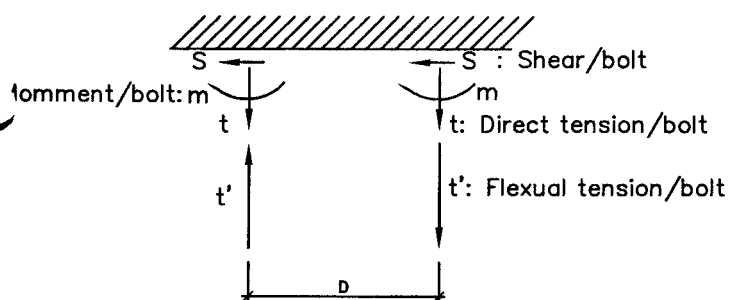
3

DATE: 4-6-04

OF 4 SHEETS



CASES I & III



CASES II & IV

A: MAX FLOOR TO MOUNTING PLATE
DISTANCE

$$A = 10'-0" = 120"$$

Vd : Dead Load (= DL)

Ve : Vertical Seismic Load (= Ev)

He : Horizontal Seismic Load (= Eh)

CASE I (FIXTURE AT HIGH POSITION)

$$d = 2.5"$$

$$D = 9.5"$$

$$Vd = 135.0 + 100.0 + 100.0 = 335.0 \#$$

$$Y = 120.0 - 80.0 = 40.0"$$

$$X = (135.0 \times 90.1 + 100.0 \times 78.3 + 100.0 \times 70.5) / 335 = 80.7"$$

$$Ve = 0.50 \times 335.0 = 165.8 \#$$

$$He = 2.83 \times 335.0 = 947.6 \#$$

$$S = 947.6 / 4.0 = 236.9 \#$$

$$t = (335.0 + 165.8) / 4 = 125 \#$$

$$\text{Total } M_{zz} = (335.0 + 165.8) \times 80.7 + 947.6 \times 40.0 = 78333 \text{ "#}$$

$$t' = 78333 / (9.5 \times 2) = 4123 \#$$

$$m = 237 \times 2.5 = 592.2 \text{ "#}$$

CASE II (FIXTURE AT LOW POSITION)

$$d = 2.5"$$

$$D = 9.5"$$

$$Vd = 335.0 \#$$

$$Y = [(120.0 - 34.6) \times 135.0 + (40.0 + 35.3) \times 100.0 + (40.0 + 35.3) \times 100.0] / 335.0 = 79.4"$$

$$X = [(50.6 + 39.5 \times \cos(60)) \times 135.0 + 43.0 \times 100.0 + 35.3 \times 100.0] / 335.0 = 51.7"$$

$$Ve = 0.50 \times 335.0 = 165.8 \#$$

$$He = 2.83 \times 335.0 = 947.6 \#$$

$$S = 947.6 / 4.0 = 236.9 \#$$

$$t = (335.0 + 165.8) / 4 = 125 \#$$

$$\text{Total } M_{zz} = (335.0 + 165.8) \times 51.7 + 947.6 \times 79.4 = 101113 \text{ "#}$$

$$t' = 101113 / (9.5 \times 2) = 5322 \#$$

$$m = 237 \times 2.5 = 592 \text{ "#}$$

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CASE III (Same As CASE I, Lateral Forces Applied Diagonally To Mounting Plate)

$$d = 2.5 \text{ "}$$

$$D = 13.4 \text{ "}$$

$$Vd = 335.0 \text{ \#}$$

$$Y = 40.0 \text{ "}$$

$$X = 80.7 \text{ "}$$

$$Ve = 0.50 \times 335.0 = 165.8 \text{ \#}$$

$$He = 2.83 \times 335.0 = 947.6 \text{ \#}$$

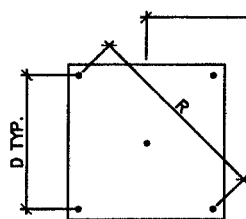
$$S = 947.6 / 4.0 = 236.9 \text{ \#}$$

$$t = (335.0 + 165.8) / 4 = 125 \text{ \#}$$

$$\text{Total } M_{zz} = (335.0 + 165.8) \times 80.7 + 947.6 \times 40.0 = 78333 \text{ "\#}$$

$$t' = 78333 / (13.4 \times 1) = 5830 \text{ \#}$$

$$m = 237 \times 2.5 = 592 \text{ "\#}$$



C.G.

CASES I & II
D = 9.5"



C.G.

CASES III & IV
 $R = 9.5(2)^{0.5} = 13.4 \text{ "}$

CASE IV

(Same As CASE II, Lateral Forces Applied Diagonally To Mounting Plate)

$$d = 2.5 \text{ "}$$

$$D = 13.4 \text{ "}$$

$$Vd = 335.0 \text{ \#}$$

$$Y = 79.4 \text{ "}$$

$$X = 51.7 \text{ "}$$

$$Ve = 0.50 \times 335.0 = 165.8 \text{ \#}$$

$$He = 2.83 \times 335.0 = 947.6 \text{ \#}$$

$$S = 947.6 / 4.0 = 236.9 \text{ \#}$$

$$t = (335.0 + 165.8) / 4 = 125 \text{ \#}$$

$$\text{Total } M_{zz} = (335.0 + 165.8) \times 51.7 + 947.6 \times 79.4 = 101113 \text{ "\#}$$

$$t' = 101113 / (13.4 \times 1) = 7526 \text{ \# GOVERNS}$$

$$m = 237 \times 2.5 = 592 \text{ "\#}$$

CHECK 7/8" DIA. A307 BOLTS:

ALLOWABLE TENSION: 12000 #

ALLOWABLE SHEAR: 6000 #

$$S = 3.14 \times d^3 / 32 = 3.14 \times (0.88)^3 / 32.0 = 0.07 \text{ "3}$$

$$fb = 592.2 / 0.07 = 9009 \text{ PSI}$$

$$Fb = 0.75 \times 36000 = 27000 \text{ PSI}$$

$$fv/Fv + ft/Ft + fb/Fb = 0.04 + 0.63 + 0.33 = 1.00 \text{ OK}$$

USE 7/8" DIA. A307 BOLTS